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BY

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ACCIDENT EXPERIENCE OF FOUR LOUISIANA PETROLEUM REFINERIES[1]

By F. E. Cash[2]

Among petroleum refinery employees and officials throughout the United States there has been marked effort to reduce accident frequency and severity. For the interest and benefit of refineries both in Louisiana and in other petroleum-refining States it has been possible to obtain from five refineries, representing 70 per cent of the production of Louisiana, the accident experience for the past 3 to 6 years.

The companies concerned have requested that their names be not used. For this reason the four plants listed and discussed are designated as refineries A, B, C, and D. The size of the plant as regards largest to smallest number of employees is indicated by the alphabetical order.

Comparative Accident Experience

According to The Safe Worker for July 1932, published by the National Safety Council, petroleum ranked fourteenth in frequency and sixteenth in severity among 28 industries in 1931.

Table 1 gives the industrial injury rates, arranged in order of severity.

As applied to this table and throughout this discussion, the following definitions are used:

Frequency is the number of lost-time injuries per million man-hours of exposure.

Severity is the number of days lost as a result of these injuries per housand man-hours exposure.

Severity or days lost per thousand man-hours of exposure as a result of njuries appears to be the most nearly logical basis for comparison of accient experience, although many if not most safety experts would probably not oncur in this conclusion.

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Table 1.- Industrial injury rates in 1931, according to the National Safety Council

Industry	Frequency		Severity	
	Rate	Rank	Rate	Rank
Average industries	15.12	-	1.72	-
Printing and publishing	9.12	4	0.25	1
Glass	11.31	9	.54	2
Tanning and leather	13.73	13	.56	3
Textile	9.11	3	.58	4
Machinery	9.57	6	.90	5
Automobile	9.48	5	.94	6
Meat packing	29.13	24	.99	7
Food	15.86	17	1.01	8
Rubber	11.78	10	1.03	9
Metal products	14.70	15	1.17	10
Nonferrous metallurgical	9.88	7	1.18	11
Electric railway	19.73	18	1.46	12
Paper and pulp	20.62	19	1.52	13
Chemical	12.65	11	1.84	14
Refrigeration	32.18	25	2.00	15
Petroleum	14.14	14	2.06	16
Public utilities	12.76	12	2.08	17.5
Railway car and equipment	15.48	16	2.08	17.5
Foundry	24.19	22	2.10	19
Steel	10.87	8	2.22	20
Woodwork and lumbering	33.54	26	2.60	21
Laundry	6.24	2	2.75	22
Cement	4.86	1	2.80	23
Marine	24.28	23	2.87	24
Ceramic	22.89	20	3.21	25
Construction	48.15	27	5.14	26
Quarry	22.98	21	6.88	27
Mining	57.24	28	9.44	28

Louisiana Petroleum Refineries

According to United States Bureau of Mines' Information Circular 6641, Petroleum Refineries in the United States, January, 1932, published in July, 1932, there were 473 petroleum refineries in the United States; 14 of these with a combined daily capacity of 224,400 barrels of petroleum were in Louisiana. The five refineries in Louisiana, all different types, from which accident information was obtained for this publication, have a daily capacity of 157,000 barrels and each is a different production and distribution unit. Since the four refineries A, B, C, and D, have more than 70 percent of the refinery capacity of Louisiana, they should give representative data for the State.

Table 2 gives the accident frequency and severity rates, with the essential data to obtain such figures, for the four plants, A, B, C, and D. As contrasted with plants A and D, it will be noted that plants B and C show an annual improvement in both accident frequency and severity.

Table 2.- Accident frequency and severity rates at refineries A, B, C, and D

PLANT A

Year	Average number of men employed	Exposure, man-hours	Injuries				Total days lost	Frequency rate	Severity rate
			Fatal	Partial perma-nent	Tempo-rary	Total			
1931	3,600	8,674,915	2	-	29	31	15,435	3.57	1.78
1930	4,556	12,268,656	1	3	69	73	11,152	5.95	.91
1929	4,651	13,646,864	2	1	99	102	17,577	8.13	1.40
1928	4,487	12,076,688	5	4	124	133	36,914	11.01	3.06
1927	4,700	12,223,092	7	2	95	104	47,704	8.51	3.90
1926	5,300	12,846,760	2	5	162	169	20,332	13.16	1.58

PLANT B

Year	Average number of men employed	Exposure, man-hours	Fatal	Partial perma-nent	Tempo-rary	Total	Total days lost	Frequency rate	Severity rate
1931	502	1,165,293	-	-	28	28	359	24.03	0.31
1930	644	1,317,527	-	-	77	77	455	58.44	.35
1929	578	1,404,861	-	1	108	109	583	77.59	.41
1928	616	1,398,361	-	-	159	159	841	113.70	.60

PLANT C

Year	Average number of men employed	Exposure, man-hours	Fatal	Partial perma-nent	Tempo-rary	Total	Total days lost	Frequency rate	Severity rate
1931	1,256	3,828,090	-	-	1	1	10	0.26	0.0026
1930	755	2,017,950	1	-	1	2	6,026	.99	2.99
1929	498	1,321,146	-	1	65	66	7,496	49.96	5.67

PLANT D

Year	Average number of men employed	Exposure, man-hours	Fatal	Partial perma-nent	Tempo-rary	Total	Total days lost	Frequency rate	Severity rate
1931	43	133,730	-	-	2	2	13	14.96	0.097
1930	64	202,240	-	1	6	7	86	34.61	.425
1929	74	236,800	-	2	24	26	219	109.80	.925
1928	79	248,850	-	2	13	15	139	60.28	.559
1927	82	255,840	-	2	19	21	231	82.08	.903

Table 3.- Accident frequency and severity data at refineries A, B, C, and D in 1929, 1930, and 1931

Refinery	1931				1930				1929			
	Employees	Man-hours	Number of accidents	Days lost	Employees	Man-hours	Number of accidents	Days lost	Employees	Man-hours	Number of accidents	Days lost
A	3,600	8,674,915	31	15,435	4,556	12,268,656	73	11,152	4,651	12,546,864	102	17,577
B	502	1,165,293	28	359	644	1,317,527	77	455	578	1,402,861	109	583
C	1,256	3,828,090	1	10	755	2,017,950	2	6,026	498	1,321,146	66	7,496
D	43	133,730	2	13	64	202,240	7	86	74	236,800	26	219
Total	5,401	13,802,028	62	15,817	6,019	15,806,373	159	17,719	5,801	15,507,671	303	25,875
Frequency	4.49				10.06				19.54			
Severity	1.15				1.12				1.67			

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During the years 1929, 1930, and 1931 these four plants had a total of 524 accidents; 208 occurred from September to February and 316 from March to August. The fewest accidents occurred in December and September and the largest number in March and July. Accidents appear to happen more frequently during the spring and summer months.

In Table 4 the accident rates are given for the four plants by months during the 3 years for which figures were available.

With 303 lost-time accidents in 1929, 159 in 1930, and 62 in 1931, a reduction of approximately 50 percent was realized between 1929 and 1930 and of more than 60 percent between 1930 and 1931. Table 3 shows that the four refineries reduced their accident-frequency rate from 19.54 in 1929 to 10.06 in 1930 and to 4.49 in 1931. The combined accident-frequency rate of 4.49 for the four refineries in 1931 is much better than the frequency rate of 14.14 for the petroleum industry as a whole in 1931 as given in Table 1. The 1931 accident-severity rate of 1.15 for the four refineries is also much better than the 2.06 severity rate given in Table 1 for the petroleum industry as a whole in 1931.

Table 4.- Accidents at four refineries, A, B, C, and D, by months

Month	1931	1930	1929	Total
January	5	14	26	45
February	4	11	23	38
March	4	18	37	59
April	5	15	35	55
May	7	11	28	46
June	5	15	33	53
July	11	20	26	57
August	5	13	28	46
September	4	11	13	28
October	6	12	17	35
November	4	11	20	35
December	2	8	17	27
Total	62	159	303	524

Table 5 classifies these accidents by causes.

Table 5.- Causes of accidents

Cause	Number
Chemicals and hot substances	77
Slipping, tripping, and stumbling	73
Dropping objects handled by injured	70
Explosions and fires	52
Flying objects	45
Falling from height	39
Hand tools	32
Falling objects	22
Moving objects	19
Machinery	17
Operation of vehicles	16
Dropping objects not handled by injured	14
Running into or striking objects	14
Fumes	13
Lifting, pulling, pushing	10
Stepping on objects	8
Electric shock or burns	3
All causes	524

Parts of Body Injured

Of these 524 lost-time accidents, foot and toe injuries lead with 138, eyes are second with 74, legs third with 49, body and face fourth with 45 each, and ankles fifth with 42 injuries.

For ease in visualizing the picture and attempting a probable solution for the various types of refinery accidents, Table 6 gives the number of injuries to the several parts of the body, in order of frequency.

Unquestionably the use of goggles, hard-toed shoes and possibly leggings would have a vital influence in lessening the occurrence of refinery accidents, and also in decreasing the severity of those which might happen.

Table 6.- Parts of body injured

Part	Number	Part	Number
Feet and toes	138	Arms	22
Eyes	74	Scalp	21
Legs	49	Strains	20
Body	45	Knees	18
Face	45	Hands	15
Ankles	42	Internal	13
Fingers	22	Total	524

Summary and Conclusion

The refineries in Louisiana have reduced their accident frequency and severity during the period covered by this report through the combined efforts of operating companies and individual employees.

In 1931, according to the Safety Division, American Petroleum Institute, reports from 89 oil companies employing 227,360 men in all parts of the United States gave the frequency as 14.14 and the severity as 2.06. During the same period in the four Louisiana plants the frequency rate was 4.49 and the severity rate 1.15.

The figures in Table 6 unquestionably indicate that if goggles were worn where the nature of the work requires them, if hard-toed (safety) shoes and leggings were worn for certain classes of work, and if more attention were given proper construction, drainage, storage, and handling materials that now cause slipping, tripping, and stumbling hazards, the accident experience of the Louisiana oil refineries would be very likely to realize a further reduction or improvement in their already good accident experience.